Design Quality Assurance Guideline

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Approved By (Acting Director)

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Active Divisions/Departments FEMC

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I. General

The review of the engineering documents should include the following:

Drafting and Engineering:

- 1. Preliminary check; quickly review and check all sheets to become familiar with the project.
- 2. Title blocks shall be set up as directed by engineering management. Sheet formats, titles, numbers, dates, etc., shall be in accordance with RPSC standards. Titles must agree with the "Index of Drawings," and all disciplines must be consistent in presentation.
- 3. General notes, abbreviations, symbols and legends shall be consistent on all drawings.
- 4. Graphic scales shall be uniform and consistently placed on each drawing, and the same applies to key plans.
- 5. Check that proper scales are used for plans, elevations, sections, and details.
- 6. Orientation (north arrows) shall be consistently placed in the same direction on all disciplines' drawings (at South Pole, grid north will be used). North shall be pointing to the top or left side of the sheet.
- 7. Check for spelling and grammar.
- 8. Check that dimensions, common control points, and building column grid lines are used with consistency between disciplines.
- 9. Check for accuracy, neatness, quality of presentation, and conformance with the applicable "drafting guide."
- 10. Check that lettering, size, style, etc. are consistent throughout all disciplines' drawings and specifications.

11. Verify consistency of terminology used on the drawings between all disciplines' drawings and specifications.

Project Engineer:

- 1. Verify consistency of technical content between disciplines.
- Check for conflicts and physical interference in building, i.e., attic spaces, under floor space, equipment rooms, chases/shafts, furred spaces, stairs, and on-site, i.e., utilities, elevations, and building location and orientation.
- 3. Verify and investigate hazardous existing conditions in the project facility, to include references to environmental assessments and surveys. Ensure adequate notes and locations are identified on the appropriate drawings, i.e., asbestos and lead paint.
- 4. Verify that plans are consistent between all disciplines.
- 5. Check for and avoid duplication of specification information on drawings. Quantitative information should appear on drawings, and qualitative information should appear in the specifications.
- 6. Check for and avoid duplication of the <u>same</u> information on more than one discipline's drawings.
- 7. Check for and avoid repetition of notes.
- 8. Verify for existing facilities where alterations and modifications are being designed, and that the definition between the new and existing items are clear.
- 9. Verify reflected ceiling plans; architectural, mechanical, and electrical plans must be coordinated to eliminate conflicts between ceiling elements, i.e., lights, diffusers, speakers, sprinkler heads, etc.
- 10. Verify on roof plans that all disciplines are coordinated, and avoid duplication of information.

- 11. Compare partial floor plans (detailed plans) against small scale overall main floor plans on all disciplines. Be sure that all other disciplines match architectural plans.
- 12. Eliminate notes such as "see architectural" or "see structural." Always refer to specific detail and sheet number.
- 13. Verify continuity between drawings where match lines are used.
- 14. Check to see that all review comments are properly corrected. Respond to each item.

II. Civil

Overall:

Check all applicable general items as listed in Section I., "General," of this document.

- 1. Verify that building floor elevations are consistent with civil drawings.
- 2. Coordinate invert elevations of utilities entering or leaving buildings with mechanical and electrical drawings.
- 3. Verify definition of limits of work between demolition and new construction, and confirm that existing and new work is identified.
- 4. Check grading existing contours, finished contours, and elevations.
- 5. Verify that dimensions are given for the location of facilities.
- 6. Verify location, size, and type of utilities, and coordination with other disciplines.
- 7. Check utility crossings for conflict.

8. Review utility road crossings for interference.

III. Architectural

Overall:

Check all applicable general items as listed in Section I., "General," of this document.

- 1. Verify floor plan dimensions with civil, structural foundation, floor framing and roof framing plans, and all column grid lines.
- 2. Verify columns and walls with structural discipline.
- 3. Points where dimensions are taken must agree with structural plans.
- 4. Verify with on-site plans that existing and new work is clearly identified.
- 5. Verify floor slopes, drains, and drain elevations.
- 6. Verify all rated walls and separations.
- 7. Check insulation values in:
 - Windows.
 - Doors.
 - Walls.
 - Floors.
 - Ceilings.
- 8. Verify recessed and semi-recessed items on all disciplines' plans, and check for adequate thickness of walls, etc.
- 9. Verify cabinets will fit spaces intended.
- 10. Check cross-references for methods and accuracy, i.e., building, wall section cuts, and details.

11. Roof Plan:

- Coordinate roof plan with structural, mechanical, and electrical drawings.
- Verify that slopes are indicated correctly.
- Verify type of roof, and coordinate with details and specifications.
- Verify location by dimension of equipment on roof and openings in roof with structural, mechanical, and electrical drawings.
- 12. Compare partial floor plans (detailed plans) with small scale overall main floor plans and verify cross-references.
- 13. Verify that access doors are provided for valves, dampers, attic space, roof, etc.
- 14. Check fire extinguisher locations.
- 15. Coordinate graphic wall types with plans. Finish schedule and specifications.
- 16. Verify vertical dimensions on elevations and floor elevations.
- 17. Verify proper orientation with respect to grid north (north arrow for project).
- 18. Check stairs, landings, and railings for elevations, structure, and dimensions.
- 19. Verify wall sections with architectural building sections and elevations.
- 20. Check structural members where indicated for sizes and shapes. (Be sure they agree with plans.)
- 21. Verify that the foundation footings, where shown, are coordinated with structural discipline.
- 22. If shielding is part of the project, verify shielding details with building plans and sections. Check structural, mechanical, and electrical drawings for possible interference. Coordinate drawings with the shielding specifications.
- 23. Toilet Rooms:

- Verify fixture types with mechanical discipline.
- Verify fixtures are located by dimension, and coordinate with plumbing drawings.
- Verify that finish materials, floors, walls, and ceilings, etc. are coordinated with schedules and specifications.
- Verify ventilation, door louver, and undercut door or transfer grille in ceiling, and coordinate with mechanical discipline.
- Verify coordination of exhaust fan with mechanical and electrical disciplines.
- Check floor drains, verify floor slope, elevations, confirm with structural and mechanical disciplines, and check types in plumbing specifications.
- Verify mirrors and all other accessories are present. Check graphic types and specifications. Verify that all electric accessories and appliances have electric power available; check voltage, phase, and hertz.
- Verify that all mechanical equipment requiring vents or flues are shown and furred in.
- Check for backing for wall hung fixtures: coordinate with plumbing drawings and specifications.

24. Kitchens, Cafeteria, and Lunch Rooms:

- If consultant is involved, coordinate his/her drawings with RPSC drawings. Coordinate with all other disciplines.
- Check materials, floors, walls, base, wainscot, ceiling, etc.: coordinate with finish schedule and details.
- Check kitchen fixtures, appliances, hoods, etc.: coordinate with mechanical and electrical disciplines.
- Check coordination of fire protection system(s) between involved disciplines. (Note: Coordinate with RPSC Safety Engineer.)
- Check plumbing fixtures, type, and location, with mechanical discipline.
- Check floor drains, floor slopes, elevations, top of drains, etc.
- Verify ventilation requirements with mechanical discipline.
- Coordinate equipment schedules with various disciplines.
- 25. Verify room names and proper orientation of interior elevations.

26. Verify that all equipment and fixtures are identified on the plans, and that the specifications are properly identified.

27. Stairs:

- Check the dimensions and coordinate with structural discipline.
- Review materials with finish schedule and specifications.
- Verify proper backing for handrail attachment.
- Review risers, treads and non-slip nosing details and check specifications.
- Compare stair plans, sections, and details with all other disciplines: structural in particular.
- Check headroom and width clearances.
- Review stair-shaft enclosure, materials of construction, and fire resistance rating.
- 28. Schedules Finish, Door, Window, and Louver:
 - Coordinate door, window, and louver sizes, types, and labels with respective schedules.
 - Review hardware sets with specifications.
 - Verify ceiling heights as indicated. Match the plan sections and interior elevations with mechanical and electrical drawings.
 - Verify wainscot height with sections, wall types, and interior elevations. Check urinal flush valve height on plumbing drawings with respect to top of wainscot.
 - Check louvers, fixed or operable: coordinate with specifications and mechanical drawings.
 - Check fire rated doors, windows, and louvers for anchorage details.
 - Check installation and anchorage details.
 - Check sound attenuating doors, details and specifications.
 - Verify details referenced in schedule for proper application.

IV. Structural

Overall:

Check all applicable general items as listed in Section I., "General," of this document.

Drawings:

- 1. Check points where dimensions taken must be the same as the architectural plans.
- 2. Verify floor elevations for continuity with civil and architectural discipline.
- 3. Check equipment locations, dimensions, and weights for electrical and mechanical requirements.
- 4. Check opening requirements in floors and roofs for stairs, chases, pipes, ducts, conduits, etc.
- 5. Verify length of all columns in column schedule.
- 6. Elevations and Sections:
 - Check building floor and roof elevations compared with civil, architectural, mechanical, and electrical drawings.
 - Verify that sections are properly labeled and cross-referenced.

7. Details:

- Check dimensions.
- Check cross-referencing.
- Check foundation for proper weight distribution and insure that heat transfer from building will not melt the supporting surface.

V. Mechanical: Heating, Ventilating and Air Conditioning (HVAC), Piping, and Fire Protection

Overall:

Check all applicable general items as listed in Section I., "General," of this document.

- 1. Check gas, water, sewer, and other utility connection locations, and invert elevations with civil drawings or to existing systems in remodel projects. Verify elevations for continuity with architectural discipline.
- 2. Check plumbing fixture count and locations against architectural plans (Note isolated fixtures).
- 3. Check plumbing fixture types for conformance to architectural and fixture schedule.
- 4. Check roof drains for conformance to architectural roof plan. Verify the pipe sizing, and that all the drains are connected. Verify that furred spaces are provided on the architectural plans to conceal the piping. Check coordination of termination with architectural and civil disciplines.
- 5. Check sanitary system and piping sizes, and ensure that all fixtures are connected.
- 6. Overlay HVAC plans with architectural reflected ceilings, architectural, structural, and electrical plans to check for possible interference.
- 7. Verify sprinkler head locations where applicable.
- 8. Check equipment horsepower ratings and voltage with electrical plans.
- 9. Verify that the equipment shown on plans is included in schedules.

- 10. Verify the structural supports required for equipment and piping are indicated on structural drawings. Also, check architectural plans for supports required for wall hung fixtures.
- 11. Check automatic fire dampers at duct penetrations for fire walls (same for smoke dampers at smoke partitions).
- 12. Verify that roof penetrations (ducts, fans, etc.) are indicated on roof plans in both architectural and structural plans.
- 13. Check that pipe and duct sizing is complete.
- 14. Verify that the note and detail/section references are correct.
- 15. Verify that exhaust fans and roof top equipment are shown on architectural plans.
- 16. Verify that mechanical systems and equipment will fit in spaced allocated with adequate servicing space. Verify that equipment can be moved in and out of building without remodeling the building or equipment.

VI. Electrical

Overall:

Check all applicable general items as listed in Section I., "General," of this document.

- 1. Check light fixtures with architectural reflected ceiling plans and mechanical plans showing diffuser and register locations.
- Coordinate all pieces of equipment with electrical design for proper power characteristics and connections.

3. Panels:

- Verify the locations of all panel boards and check that they are indicated on the electrical riser diagram.
- Coordinate panel locations with architectural and mechanical plans for possible interference and sufficient space panels.
- Check wall construction thickness for recess panels.
- 4. Check for adequate space and clearances for cable tray, conduit, lights, etc., in all spaces, such as, above ceiling (attic) and space below free access floors. Coordinate with other disciplines to eliminate interference.
- Check exit light locations with architectural reflected ceiling plans and fire protection plans. Verify emergency/night light requirements and locations.
- 6. Check to ensure there are adequate lights in stairs. Verify with architects if lights are required over entrances.
- Check single line diagrams to make sure that equipment power needs are properly provided.
- 8. Compare single line diagrams to panel schedules.
- 9. Check all grounding requirements and details: coordinate with other disciplines.
- 10. Check architectural and mechanical disciplines to verify electrical requirements for elevators, doors, operations, dumb waiters, kitchen equipment, hand dryers, water coolers, or other items requiring electrical power.
- 11. Verify telephone, communication, and alarm system requirements: coordinate with other involved disciplines. Check security door requirements.
- 12. Coordinate with architecture discipline to ensure access for the maintenance and servicing of all equipment, including roof mounted equipment.

- 13. Coordinate underground utility routing and arrangement with water, sewer, fuel oil, and other piped utilities to avoid conflict. Check with civil discipline to avoid routing conflicts, including road layouts.
- 14. Verify motor information for equipment furnished by civil, mechanical and architectural plans.
- 15. Verify fence grounding requirements with civil discipline.
- 16. Verify power and communication requirements with instrumentation panel or devices, etc.
- 17. Check to ensure bonding and grounding requirements are met.
- 18. Check to ensure that lighting protection requirements are met.
- 19. Verify proper kitchen equipment power is provided.
- 20. Review drawings and specifications for consistency and uniformity. Verify that equipment and materials shown on the drawings are covered in the specifications. Review all notes and references.
- 21. Check terminology for consistency between the drawings and the specifications.
- 22. Verify that all power distribution panels, breaker switches, emergency generators, and emergency power transfer switches are properly matched to load requirements.

Records

This procedure generates no records.